Water Powers of Canada

The

Maritime Provinces

Prince Edward Island
New Brunswick
Nova Scotia

By K. H. Smith

"An examination of any good map of our broad Dominion, reveals, as its most striking feature, an extraordinary wealthy and remarkably uninterrupted succession of lakes and rivers, suggestive of ample rainfall, the first great requisite in the occupation of any country. Over a length of several thousand miles, between Labrador and Alaska, and over a width of several hundred miles, there is an almost continuous distribution of lakes; lakelets and rivers; the lakes of varied outlines, dimensions and elevations above sea level, and many possessing facilities for the storage of their flood waters. In many places the outlet from the lake or the connection between a chain of lakes is a narrow cleft in rock where an inexpensive dam will hold back the water supplied by the winter's accumulation of snow."

From a Presidential address on the Water Powers of Canada before the Royal Society of Canada, in 1898-99, by the late T. C. Keefer, C.E. C.M.G., Honorary Member of the Institute, American Society and Canadian Society, of Civil Engineers; Past President of the American and Canadian Societies of Civil Engineers.

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Dominion Water Power Branch
Department of the Interior
Ottawa, Canada

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THIS monograph on the Water Powers of the Maritime Provinces, published by direction of the Honourable W. J. Roche, Minister of the Interior, Canada, was written by K. H. Smith, B.A., A.M. Can. Soc. C.E., Engineer of the Nova Scotia Water Powers Commission, at the request of the Superintendent of the Dominion Water Power Branch, for distribution in connection with the water power exhibit of the Dominion Government in the Canadian Pavilion at the Panama-Pacific Exposition.

This water power exhibit was prepared by the Dominion Water Power Branch, under the direction of the Commissioner General of Canadian Exhibitions, with the object of showing visitors to the Exposition the tremendous water power resources of Canada, and especially the great progress already made in the art of power development and use throughout the Dominion.

The outstanding feature of the water power situation in Canada is the fact that practically all industrial and commercial centres in the Dominion, from coast to coast, have sufficient potential water power within easy transmission radius and of sufficient capacity and assured economic feasibility of development to meet all anticipated requirements for the future.

INTRODUCTION

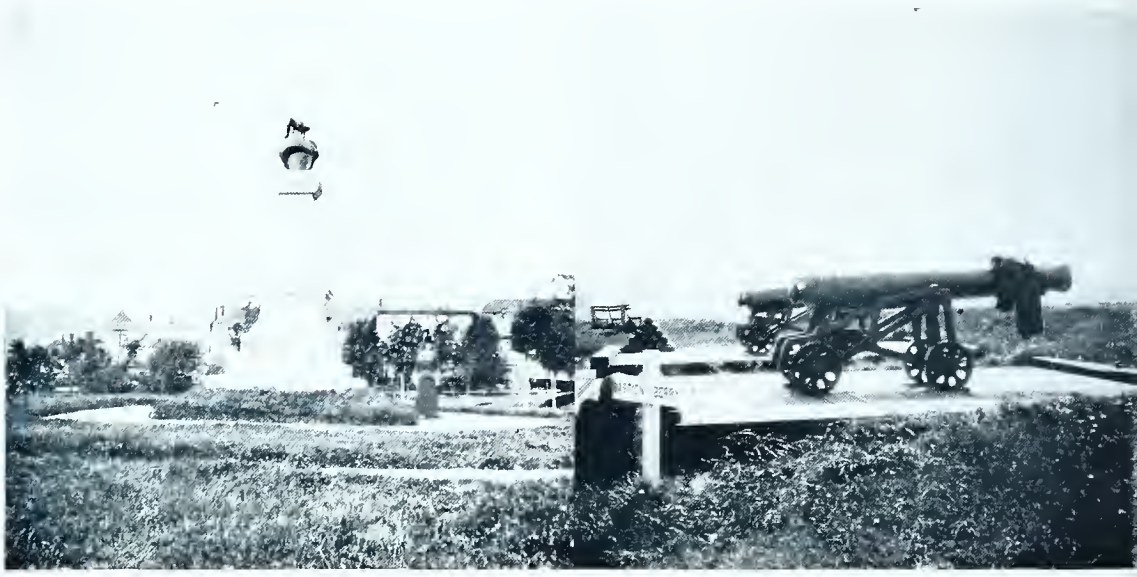
THE Canadian Provinces by the sea are full of romantic interests. In New Brunswick, the beautiful St. John River valley, with its green meadows and rolling uplands, has witnessed many a clash of arms, and is replete with Indian lore. Among such is the legend of the Indian maid of the Maliceet tribe who, captured by the Mohawks, guided her captors safely over the portage by the Madawaska Falls and into the St. John River, only to lure them to death over the brink of Grand Falls. It is said her own body is still concealed by the river, and doubtless should the water from this mighty cataract be diverted for the white man's purposes, lonely remnants of this old tribe will be found searching for some evidence of their lost heroine.

Across the Bay of Fundy, well sheltered in an ample basin, lies the old Nova Scotia town of Annapolis Royal. Here was established the earliest European settlement in the Dominion of Canada. Rusting cannon, tumble down magazines and grass grown bastions, are eloquent of many bloody encounters in which French, English and New England Colonials took part while Canada was in the making. The name itself is suggestive of early French days when the settlement was known as Port Royale. Far to the other extremity of Nova Scotia, at Louisbourg, are remains of fortifications representing the best efforts of famous French military engineers, and years of toil. Before these works, powerful fleets battled for the New World supremacy.

Between these two grim reminders of bloody battles lies the peaceful "Land of Evangeline," with its broad meadows, so patiently reclaimed from the waters of Minas Basin by the simple Acadian farmers. The old City of Halifax itself is like a bit of England transplanted.

The whole country abounds in little ocean coves, with inviting cottages nestling here and there on their shores, sparkling streams leaping from boulder to boulder where lively trout disport themselves, and vast areas where big game, to delight the heart of any hunter, may be found.

There is, however, another and more practical side to this country so full of memories and so well adapted for pleasure and recreation. Vast quantities of coal and iron ore are available in certain areas, and large industries have been founded on these. Enormous quantities of valuable timber still exist, while the fisheries are of great value. Gold mining is carried on profitably in several places, while in large sections of the country agriculture has the foremost place. Water powers are numerous and valuable, and while perhaps secondary in importance to the great mineral and agriculture wealth of the province, will be an extremely valuable ally to these other natural resources in the ultimate development of the whole country.



Monument to the Earliest European Settlement in Canada, Annapolis, N.S., and Old Cannon, Annapolis, N.S.

Iron Ore Separator, Operated Electrically with Power from Nictaux Falls, Nova Scotia.

Dam on Lequille River, Nova Scotia, for Annapolis Electric Light Plant.

they are at or near navigable water. Grand Falls is at the head of navigation on the St. John River, while the other sites mentioned are close to excellent ocean harbours, such as at Liverpool, Sheet Harbour and Minas Basin.

The Maritime Provinces are particularly rich in timber and minerals, such as iron, gold and coal, and it would seem that some of the larger sites could be very profitably developed in connection with large industries founded on these natural products. It is probable that in the near future, electrical energy will play a large part in the reduction of various iron ores and the manufacture of certain kinds of steel.

A number of smaller sites in Nova Scotia are so situated as to be of great service in connection with gold mining. Already some development along this line has been done

Fish Ladder, Lower Pulp Mill Dam, Mersey River, Nova Scotia.

at Isaac Harbour, but examples of much greater magnitude are to be found in the Yukon Territory, Canada, where two plants, one of 10,000 horse-power capacity, are utilized for this purpose.

A large coal company, on Vancouver Island, British Columbia, has found it profitable to develop a water power site adjacent to its mines, in order to utilize the energy thereby secured for mine operation purposes. This co-operation, so to speak, of water power and coal, two rival sources of power gives a new aspect to such a question, and no doubt similar advantageous arrangements could be made at some places in Nova Scotia.

Agriculture, the basic industry of all civilization and the chief asset of this maritime country merits the best study and attention that can be given to it. With special reference to Nova Scotia, it is well to speculate on the transformation that might be worked in such already far-famed districts as the Annapolis and Cornwallis valleys, by flooding them with cheap light and power. Some idea of the results obtainable is given by the appearance of certain sections of the Niagara Penninsula, in the Province of Ontario, where the combination of excellent soil and climate, with an abundant supply of electricity for transportation, domestic and field use, has turned whole blocks of country into veritable gardens. It would seem that certain sections of the Maritime provinces have like possibilities, where small sites are available close at hand, thereby eliminating expensive transforming apparatus and long transmission lines.

Existing developments are mainly of two types: first, those based on the timber resources of the country, such as saw mills, pulp and paper mills; second, those developed and used by small municipalities for local lighting and small motor loads. In a few cases too, small water powers are used to drive woollen mills and grist mills. The largest water power plants are used for the manufacturing of pulp and paper. In this field particularly, many excellent opportunities for the use of water power are available. The interior of New Brunswick is one vast forest, with timber especially adapted for pulp and paper making purposes. Large areas could, no doubt, be made to produce pulp wood perpetually by the application of approved forestry methods. The development of small powers for local municipalities is also a promising field, while in some cases, larger powers near the sea coast offer exceptional opportunities for industrial activity.

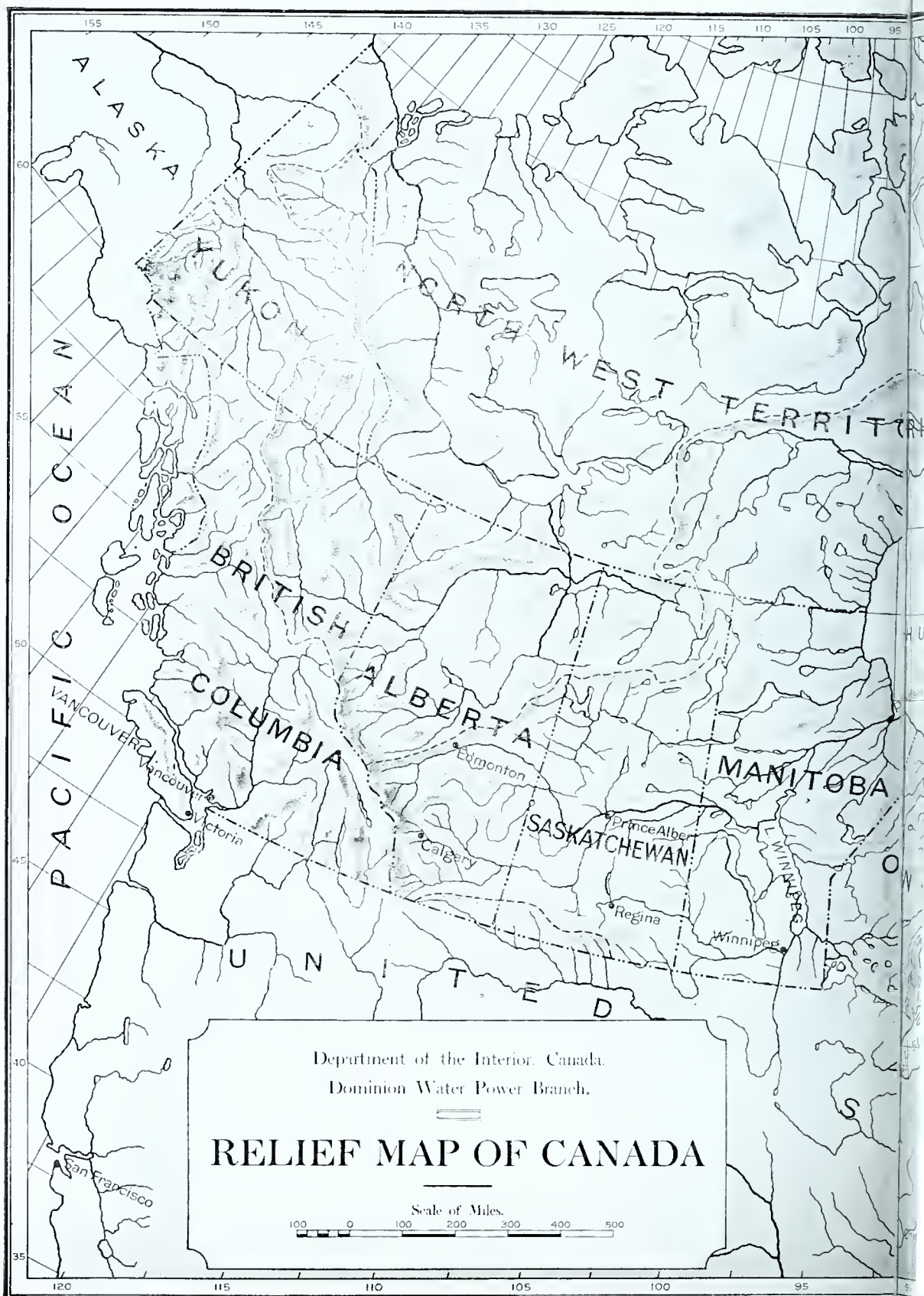
On the whole, it appears that the available water power in the Maritime Provinces is ample for all present and future needs. Present developments for pulp and paper purposes and for local domestic or municipal use point the way to future expansion along those lines, while in the foregoing three, as yet only slightly exploited fields, more or less peculiar to the country are suggested: first, in connection with the application of electrical energy to agricultural pursuits; second, in connection with mining industries; third, in connection with industrial activity at sea ports.

Old Logging Dam, used for Storage Purposes.

St. John River above Grand Falls, N.B.

Gold Mine Building and Tramway, Isaac Harbour, Nova Scotia. Operated Electrically.

Gold Stamp Mills, Isaac Harbour, Nova Scotia. Operated Electrically.

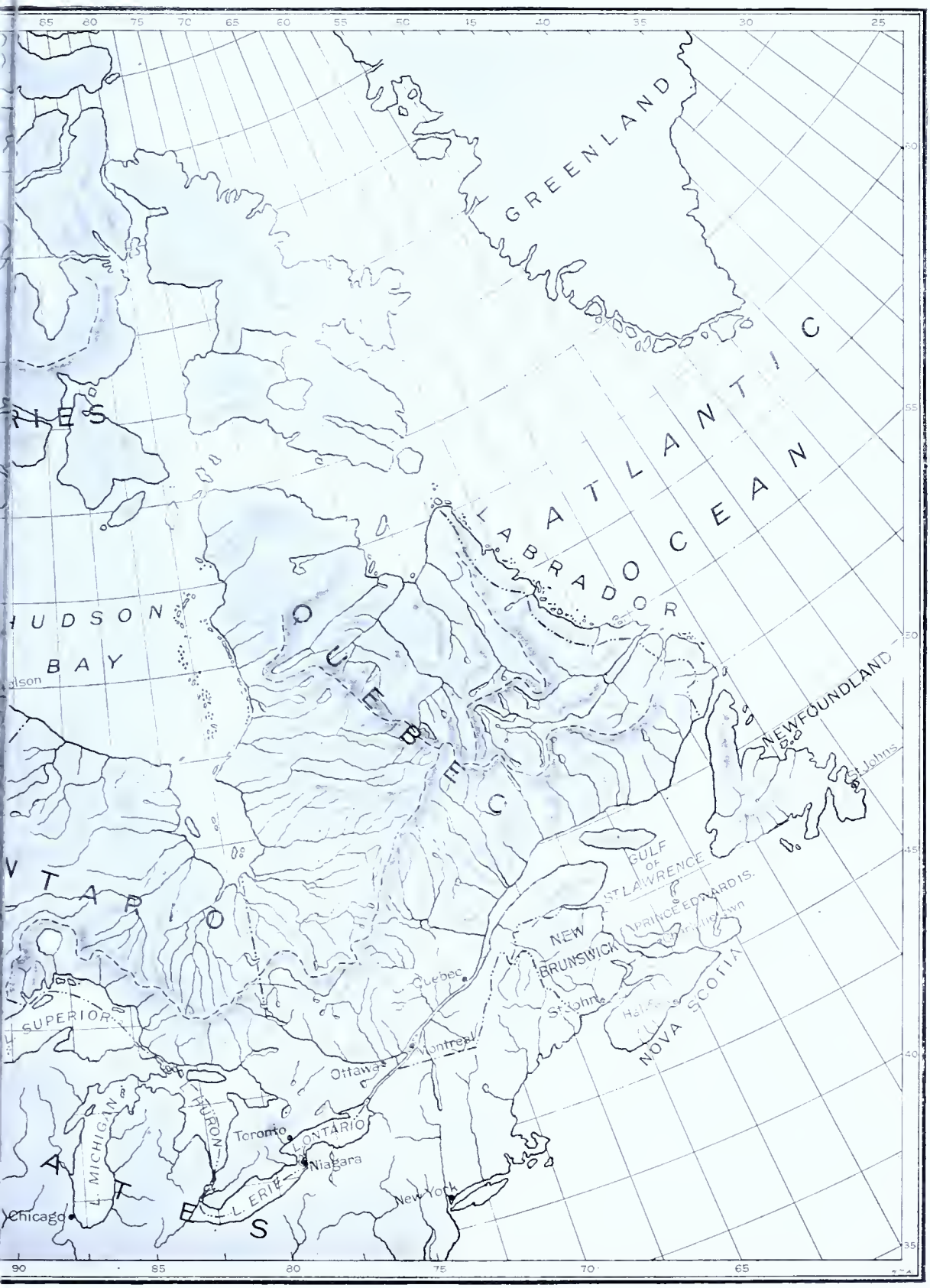


Department of the Interior, Canada.
Dominion Water Power Branch.

RELIEF MAP OF CANADA

Scale of Miles.

100 0 100 200 300 400 500


GREENLAND
ATLANTIC OCEAN
LABRADOR
HUDSON BAY
QUEBEC
NEWFOUNDLAND
St. Johns
GULF OF ST. LAWRENCE
PRINCE EDWARD IS.
Charlottetown
NEW BRUNSWICK
St. John
NOVA SCOTIA
Halifax
Quebec
Montreal
Ottawa
Toronto
Niagara
ONTARIO
L. ERIE
HURON
L. MICHIGAN
SUPERIOR
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Pulp Mill, Magaguadavic River, N.B.

Log Driving on a New Brunswick River.

Dam, Old Mill on the Left and Electric Light Plant on the Right, Bear River, N.S.

SOURCES OF INFORMATION AND WATER POWER LEGISLATION

CONSIDERABLE information is available with respect to certain water powers in these provinces. At Grand Falls, on the St. John River, the largest water power in the Maritime provinces and one of the largest sites in Canada, a large amount of work has been done by the International Commission pertaining to the St. John River, which latter Commission has collected much valuable hydraulic data in connection with the whole drainage basin of the St. John River. The United States Government, through its Geological Survey, and also the State of Maine for a number of years, have conducted investigations relating to the inland waters of the State of Maine. The St. John River, with a number of its tributaries, has its sources in the State of Maine, while the St. John itself with the St. Croix, forms part of the International boundary between the province of New Brunswick and the State of Maine. Accordingly, the work done by the

United States, referred to above, is of great service in connection with the study of water power possibilities in New Brunswick and elsewhere, both directly and by analogy.

In another respect too, the Maritime Provinces are better off for water power data than other parts of Canada. Quite a number of meteorological stations are maintained by the Meteorological Service, Department of Marine and Fisheries, Canada, and at most of these, rainfall records extending over a large number of years are available. Evaporation stations are also maintained in the adjoining State of Maine by the United States Geological Survey, the results of which are useful in considering New Brunswick waters.

While few adequate records have been kept at existing developments, still the history of most of these indicates in a rough way the amount of water available and the regimen of flow for the various streams on which they exist, as also for similar streams in the same district.

The Province of New Brunswick has regulations governing the granting and development of water powers within its borders, while Nova Scotia has appointed a Water Powers Commission to investigate the water power resources of the province and outline a progressive policy in connection with their development.

Reversible Falls, St. John River, N.B.

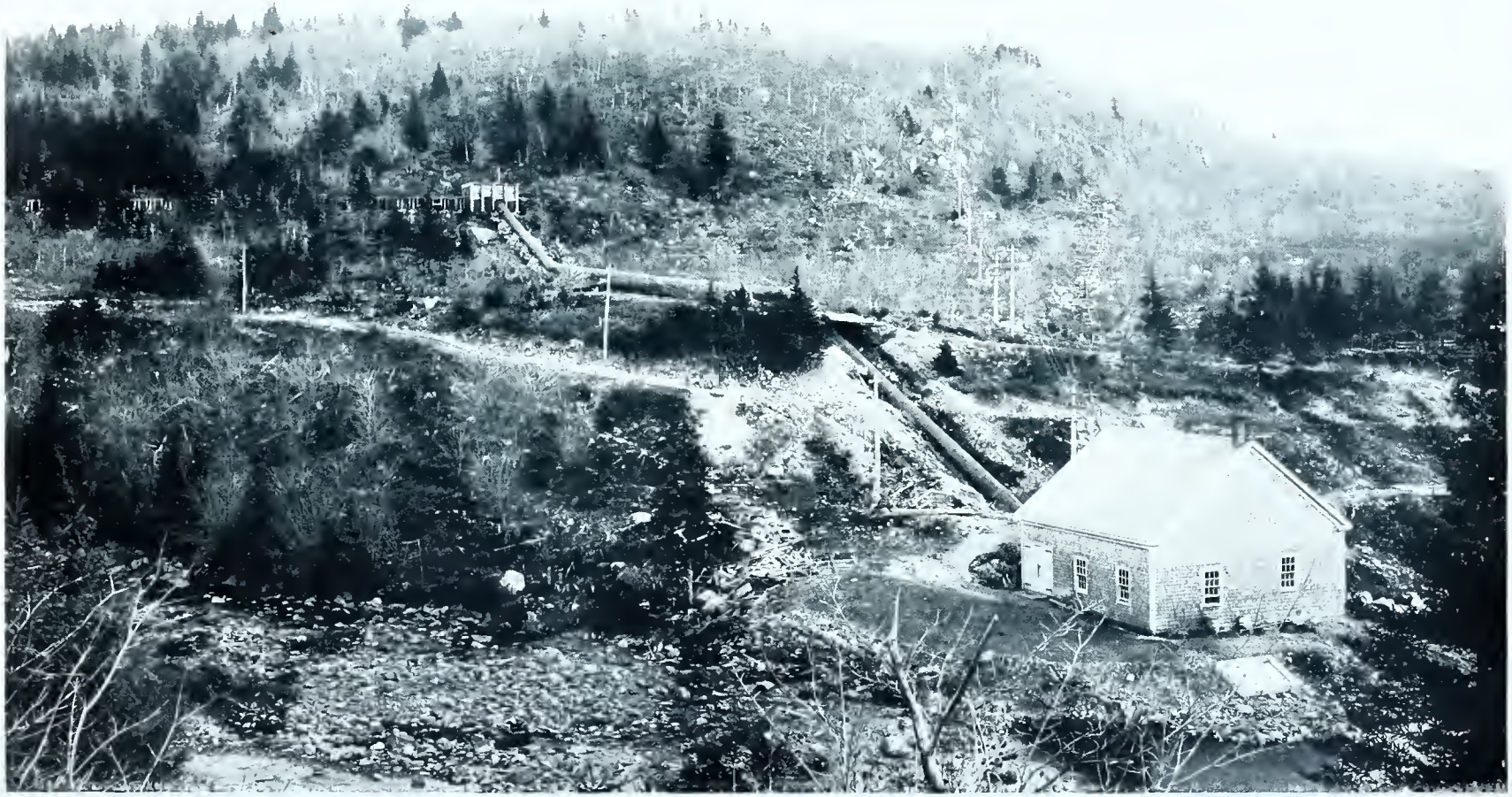
WATER POWERS ALREADY DEVELOPED

IT is estimated that in New Brunswick there has been developed to date about 13,000 horse-power. Of this amount 56 per cent. consists of small saw mills, grist mills and pulp mills, while the balance is made up of small electric plants from 100 to 500 horse-power capacity, and one plant with 3,800 horse-power installed. This plant, one of the largest single electrical developments in the province, is located on the Aroostook River at Aroostook Falls, but the greater part of the output is used across the border in the State

Power Plant on the Aroostook River, N.B.

of Maine. Small plants exist at Bathurst, Centreville, Edmunston, St. Stephen, Shediac and Woodstock, all of which are privately owned, except the Edmunston development, which is a municipal enterprise.

In Nova Scotia about 21,000 horse-power has been developed. Of this amount, 12,650 horse-power is used in the manufacture of pulp and paper, 2,700 horse-power consists of small electric light developments, 350 horse-power is used for gold mining purposes at Isaac Harbour, and the balance is made up of numerous saw mills and grist mills. Small electric light plants exist at the following places:—Annapolis Royal, Bear River, Bridgetown, Bridgewater, Dartmouth, Liverpool, Lunenburg, Yarmouth and Shelbourne. The plants at Annapolis, Bridgewater and Liverpool, are owned and operated by the Municipalities, and



Hydro-Electric Plant Operating Gold Mine, Isaac Harbour, N.S.

Pipe Line Annapolis Electric Light Plant, N.S.

Liverpool Hydro-Electric Plant, Mersey River, N.S.

Lower Pulp Mill Dam, Mersey River, N.S.

Nictaux Falls, Nova Scotia.

one of the largest single electrical developments is that supplying the town of Liverpool. This plant is on the Mersey River and has 750 horse-power installed. Two comparatively large pulp and paper mills are also situated on the Mersey River, the upper one having a capacity of 3,000 horse-power, and the lower one 1,500 horse-power. On the Sissibou River, at Weymouth, there is a pulp mill with 2,000 horse-power installed, while other similar developments exist on the Lahave, Medway, Clyde and St. Croix Rivers.

So far as Prince Edward Island goes, nearly every stream has one or more small water power developments ranging from 5 to 50 horse-power. Such developments are used in connection with small mills of various kinds, principally grist mills and woollen mills, and rarely operate throughout the whole year. There is one hydro-electric development on the Montague River, supplying the village of the same name, where 44 horse-power is installed. It is estimated that 500 horse-power is developed on the Island.

East Branch, Bear River, N.S., at Head of Tide-water. Granite Works on Right.

Dam and Old Mill on the Lequille River above Annapolis Royal.

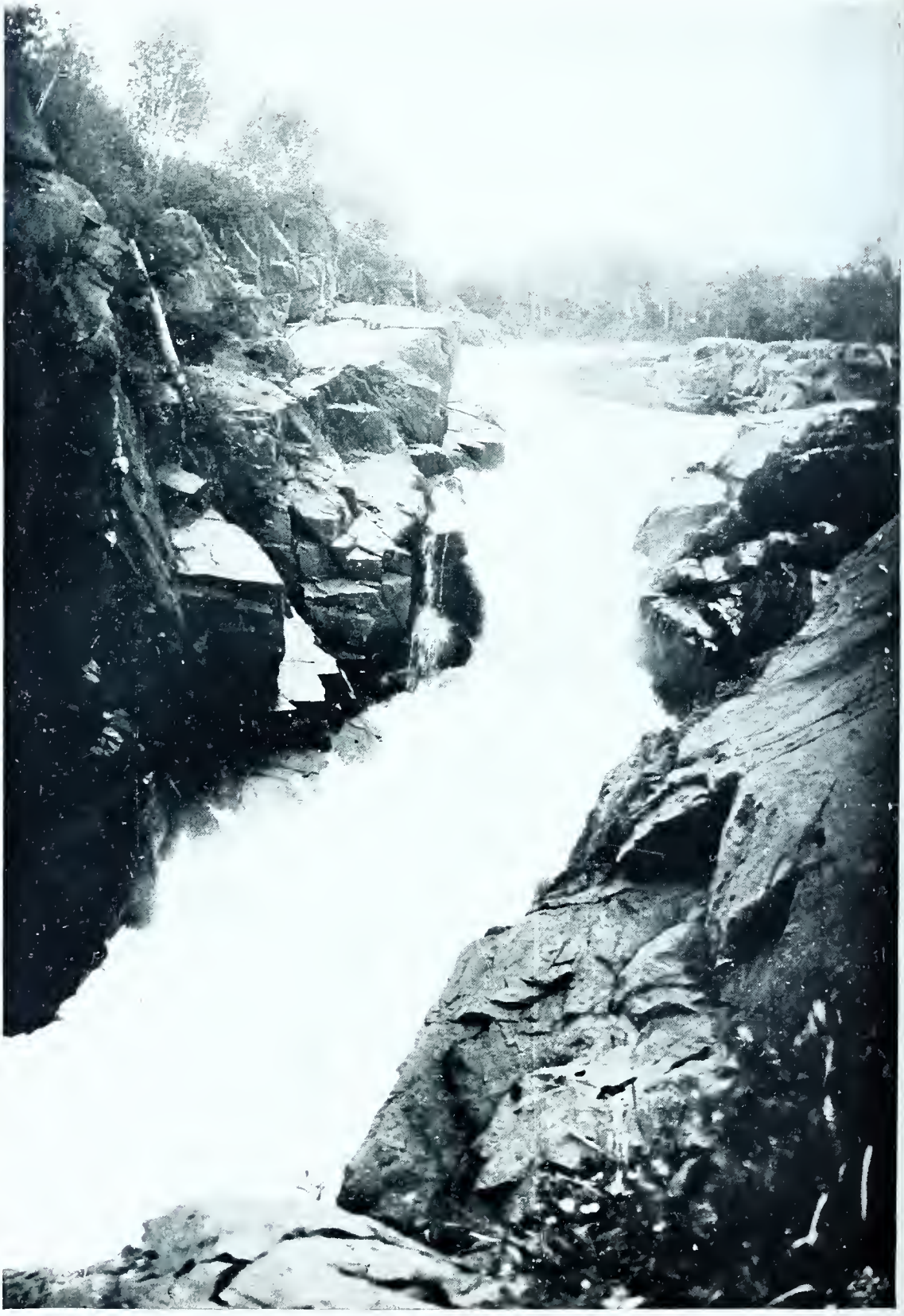
UNDEVELOPED WATER POWERS

ONE of the chief assets of the Maritime Provinces in undeveloped water powers lies in the large number of small sites available for domestic use or for small municipalities. One or more such sites exist on practically every stream throughout the district, and a number of municipalities, as outlined above, have already taken advantage of some of these opportunities.

There are, however, a number of places where large amounts of power may be developed, some of which have been given considerable attention, and it is only a few of these larger sites that can be mentioned here.

There are two outstanding power sites in New Brunswick, Grand Falls on the St. John River, and Grand Falls on the Nepisguit River.

The St. John River drains by far the largest basin of any river in the Maritime Provinces. The total area of this basin is 26,000 square miles, of which about 5,000 square miles is within the State of Maine. The largest water power in the Eastern part of Canada exists



Grand Falls, Nepisguit River, N.B.

Canyon below Grand Falls, Nepisguit River, N.B.

Mersey River at Head of Tide. Old Water Driven Saw Mills on the Right.

at Grand Falls, on this river, about 200 miles from the City of St. John. A scheme of development has already been outlined, whereby it is proposed to install 80,000 horse-power under a head of 140 feet. There is another place on the river, known as the Pokiok site, much nearer St. John, where there is said to be about 30,000 horse-power available.

The Nepisguit, or "River of Foaming Waters," is a very rugged stream in the northern part of New Brunswick, much frequented by hunters and fishermen. Its headwaters adjoin those of the Tobique, a tributary of the St. John, so that these streams offer a water route for sportsmen through the heart of some of the best hunting and fishing grounds in North America. There are a number of rapids and falls on the Nepisguit, the most spectacular of which is Grand Falls. This is located about 20 miles from the town of Bathurst, and upwards of 10,000 horse-power is available with a head of 125 feet.

Such rivers as the Miramichi, Tobique and Aroostook, are also known to have a number of large power sites.

In Nova Scotia, three possible sources of comparatively large amounts of power have been considered, and construction on a fourth has been started. The Mersey River, commercially

Dam on Mersey River, N.S., at High Water.

Upper Pulp Mills, Mersey River, Nova Scotia.

St. Margaret's Bay, Nova Scotia.

Head of Big Falls, East Branch of Bear River, Nova Scotia.

the most important river in the Province, has exceptional storage facilities in lakes at its head-quarters. There is said to exist on it the possibility of developing upwards of 30,000 horse-power at several sites. As yet only 4,250 horse-power has been developed at three different places. East River, Sheet Harbour, is also said to be capable of producing 16,000 horse-power, and has excellent storage facilities on numerous lakes scattered throughout the drainage basin. Data is not at hand to verify the above figure. The Gaspereaux river is also well supplied with storage basins, and according to a scheme outlined by a reputable firm of Engineers, it is possible to obtain 8,000 horse-power from this river under a head of 450 feet. Such a development in the heart of the best farming district in the province ought to be very valuable, and besides is within transmission distance of the City of Halifax. Work has been started on an unique scheme within twenty miles of Halifax, the output of which is intended to supply that city. This scheme, besides storage, in a number of lakes, involves the entire diversion of one stream into another, and the installation of turbines acting under different heads in the same power house. The combined flow of the two rivers is again to be used in a second power house, situated at tide water, on St. Margaret's Bay. It is

Scenes in the Maritime Provinces.

estimated that 2,160 continuous horse-power may be obtained from this plant as well as 3,210 horse-power extra for 12 hours daily.

Owing to the nature of the information already at hand, and in view of the fact that further investigations are under way, it is not considered advisable at the present time to make any estimate of the total power available in the Maritime Provinces. In several cases already, a little careful study has revealed very attractive power sites hitherto unsuspected by the casual observer, where ingenious but inexpensive storage schemes, diversion of one stream to another, or combinations of several sites are involved. Suffice it to say that many water powers admirably suited to the various needs of the country do exist, and any efforts put forth by those interested to find such will be amply rewarded.

Charlo Falls, Charlo River, N.B.

For further information regarding water powers in Canada, application should be made direct to the following administrative officers of the Dominion and the various Provincial Governments:

Province of British Columbia: The Comptroller of Water Rights, Victoria, B.C.

Provinces of Manitoba, Saskatchewan and Alberta: The Superintendent of the Dominion Water Power Branch, Ottawa, Ont.

Province of Ontario: The Deputy Minister of Lands, Forests and Mines, Toronto, Ont; also, to the Secretary of the Hydro-Electric Power Commission of Ontario, Toronto, Ont.

Province of Quebec: The Chief Engineer, Hydraulic Service, Department of Lands and Forests, Quebec, Que.

Province of New Brunswick: Surveyor-General of New Brunswick, Fredericton, N.B.

Province of Nova Scotia: The Secretary of the Nova Scotia Water Power Commission, Halifax, N.S.